Experiment: Generate N random points in $[-1,1] \times [-1,1]$. Study the condition number of the matrix Φ in function of N.

- $\varphi(t) = \sqrt{1+t^2}$

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N = 10   Condition number Phi (2-norm) = 7.269964e+03
N = 20   Condition number Phi (2-norm) = 1.504188e+06
N = 30   Condition number Phi (2-norm) = 5.917494e+06
N = 40   Condition number Phi (2-norm) = 2.946382e+08
N = 50   Condition number Phi (2-norm) = 3.874386e+09
N = 60   Condition number Phi (2-norm) = 7.367975e+09
N = 70   Condition number Phi (2-norm) = 9.365135e+09
N = 80   Condition number Phi (2-norm) = 7.575494e+11
N = 90   Condition number Phi (2-norm) = 6.665645e+12
N = 100  Condition number Phi (2-norm) = 1.117023e+12
N = 110  Condition number Phi (2-norm) = 1.760513e+13
N = 120  Condition number Phi (2-norm) = 1.059863e+13
N = 130  Condition number Phi (2-norm) = 1.809455e+13
N = 140  Condition number Phi (2-norm) = 1.461977e+14
N = 150  Condition number Phi (2-norm) = 6.021677e+15
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- $\varphi(t) = e^{-t^2}$

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N = 10   Condition number Phi (2-norm) = 8.932403e+02
N = 20   Condition number Phi (2-norm) = 8.058877e+05
N = 30   Condition number Phi (2-norm) = 2.167539e+07
N = 40   Condition number Phi (2-norm) = 6.016862e+09
N = 50   Condition number Phi (2-norm) = 4.612961e+11
N = 60   Condition number Phi (2-norm) = 1.447769e+12
N = 70   Condition number Phi (2-norm) = 1.334052e+13
N = 80   Condition number Phi (2-norm) = 2.533721e+15
N = 90   Condition number Phi (2-norm) = 8.228207e+17
N = 100  Condition number Phi (2-norm) = 6.434271e+16
N = 110  Condition number Phi (2-norm) = 1.051642e+18
N = 120  Condition number Phi (2-norm) = 2.853435e+18
N = 130  Condition number Phi (2-norm) = 1.511687e+18
N = 140  Condition number Phi (2-norm) = 1.970897e+18
N = 150  Condition number Phi (2-norm) = 2.562427e+18
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Experiment: Generate N random points in $[-1,1] \times [-1,1]$. Study the condition number of the matrix

$$\begin{bmatrix} \Phi & P^T \\ P & 0 \end{bmatrix}$$

in function of N.

- $\varphi(t) = \sqrt{-t^2}$ and $p_j(x)$ the multinomial basis in $\mathbb{R}^2$ for quadratic polynomials.

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N = 10   Condition number [Phi P^T ; P 0] (2-norm) = 5.623641e+02
N = 20   Condition number [Phi P^T ; P 0] (2-norm) = 1.239363e+04
N = 30   Condition number [Phi P^T ; P 0] (2-norm) = 1.307286e+05
N = 40   Condition number [Phi P^T ; P 0] (2-norm) = 2.762456e+05
N = 50   Condition number [Phi P^T ; P 0] (2-norm) = 5.213751e+05
N = 60   Condition number [Phi P^T ; P 0] (2-norm) = 1.321198e+06
N = 70   Condition number [Phi P^T ; P 0] (2-norm) = 9.347869e+05
N = 80   Condition number [Phi P^T ; P 0] (2-norm) = 1.822913e+07
N = 90   Condition number [Phi P^T ; P 0] (2-norm) = 8.002047e+06
N = 100  Condition number [Phi P^T ; P 0] (2-norm) = 2.292679e+06
N = 110  Condition number [Phi P^T ; P 0] (2-norm) = 1.517638e+07
N = 120  Condition number [Phi P^T ; P 0] (2-norm) = 2.205892e+07
N = 130  Condition number [Phi P^T ; P 0] (2-norm) = 8.969889e+06
N = 140  Condition number [Phi P^T ; P 0] (2-norm) = 4.447364e+07
N = 150  Condition number [Phi P^T ; P 0] (2-norm) = 1.834383e+08
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- $\varphi(t) = t^2 \ln(t)$ and $p_j(x)$ the multinomial basis in $\mathbb{R}^2$ for quadratic polynomials.

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N = 10   Condition number [Phi P^T ; P 0] (2-norm) = 5.992217e+01
N = 20   Condition number [Phi P^T ; P 0] (2-norm) = 5.185609e+02
N = 30   Condition number [Phi P^T ; P 0] (2-norm) = 6.543852e+03
N = 40   Condition number [Phi P^T ; P 0] (2-norm) = 7.580307e+03
N = 50   Condition number [Phi P^T ; P 0] (2-norm) = 1.025197e+04
N = 60   Condition number [Phi P^T ; P 0] (2-norm) = 2.618059e+04
N = 70   Condition number [Phi P^T ; P 0] (2-norm) = 1.967010e+04
N = 80   Condition number [Phi P^T ; P 0] (2-norm) = 2.477802e+05
N = 90   Condition number [Phi P^T ; P 0] (2-norm) = 1.001769e+05
N = 100  Condition number [Phi P^T ; P 0] (2-norm) = 3.724034e+04
N = 110  Condition number [Phi P^T ; P 0] (2-norm) = 2.175484e+05
N = 120  Condition number [Phi P^T ; P 0] (2-norm) = 3.293389e+05
N = 130  Condition number [Phi P^T ; P 0] (2-norm) = 1.472904e+05
N = 140  Condition number [Phi P^T ; P 0] (2-norm) = 4.375214e+05
N = 150  Condition number [Phi P^T ; P 0] (2-norm) = 8.782896e+05
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